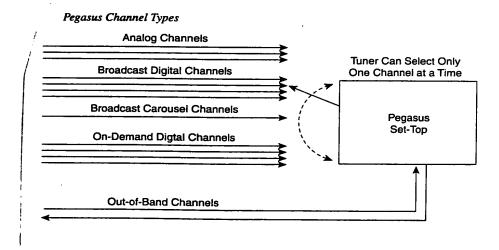


PRIOR ART

TIME WARNER FULL SERVICE NETWORK

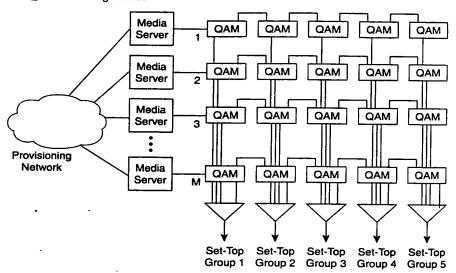
PROTOCOL STACK

FIG. 1



PRIOR ART
PEGASUS 2 CHANNEL TYPES
FIG. Z

### **QAM Switching Matrix**



PRIOR ART.

PEGASUS Z QAM SWITCHING MATRIX TO IMPLEMENT MPEG-Z TRANSPORT SWITCH

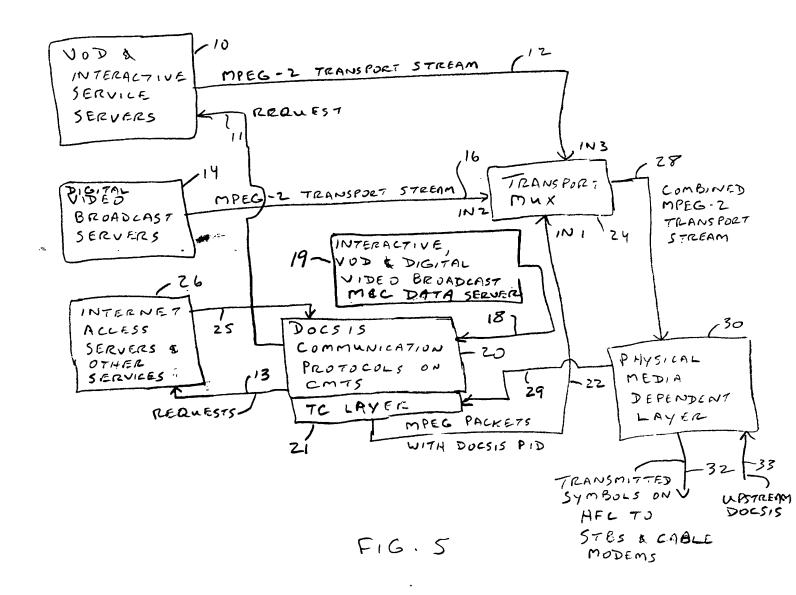
F16.3

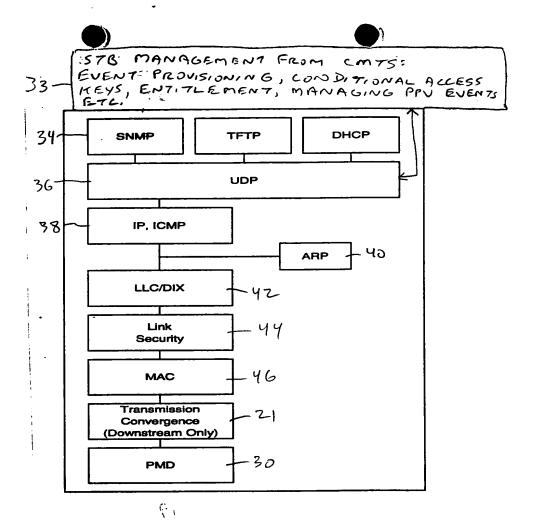
#### Communications Stack

TCP	UDP			
Internet Protocol (IP)		MPEG Audio	MPEG Video	
ATN	Adaptation Layer 5	(AAL-5)		
Asyno	chronous Transfer Mo	de (ATM)		NTSC 6-Mhz Channels
Physical Layer Convergence Prodedure	Time Division Multiple	SA Multi-Rate Transport (SA-MRT)		Chameis
DS1 Extended Super Frame	Access			
Quadrature Phase Shift Keying (QPSK)		Quadrature Amplitude Modulation (QAM-64)		
	Frequency D	Division Multiple:	king	

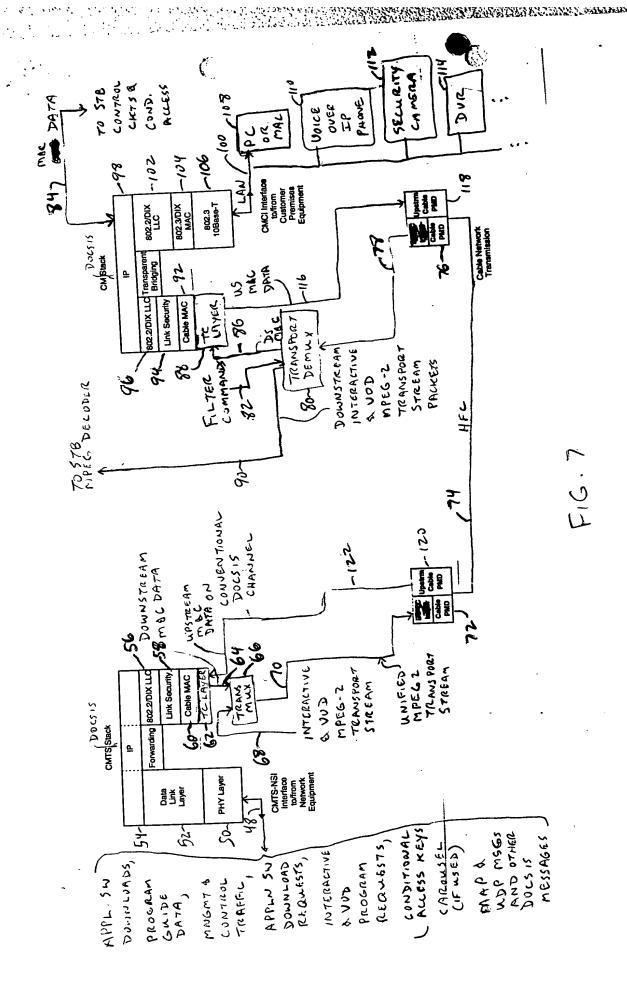
## PRIOR ART

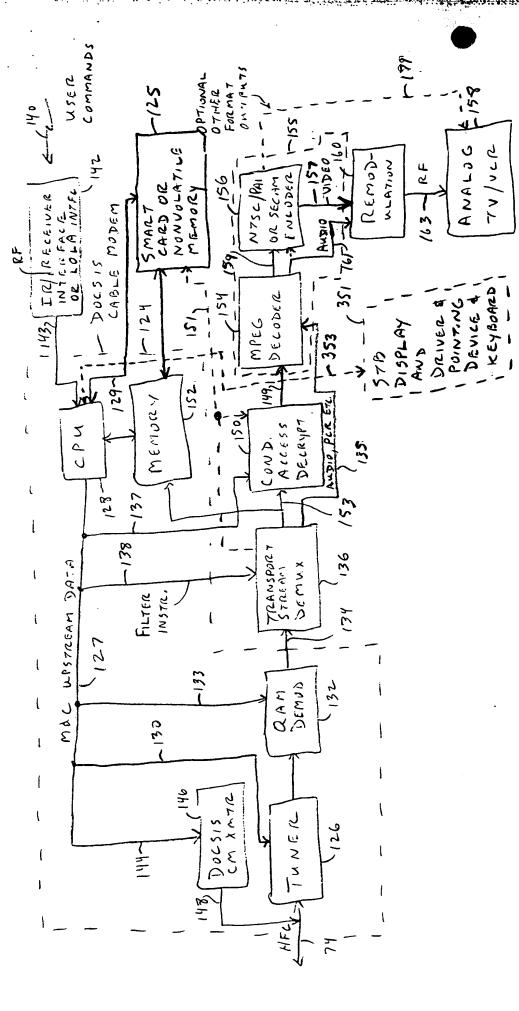
FSN COMMUNICATION PROTOCAL STACH
MPEG DELIVERED OVER ATM SWITCHED NETWORK





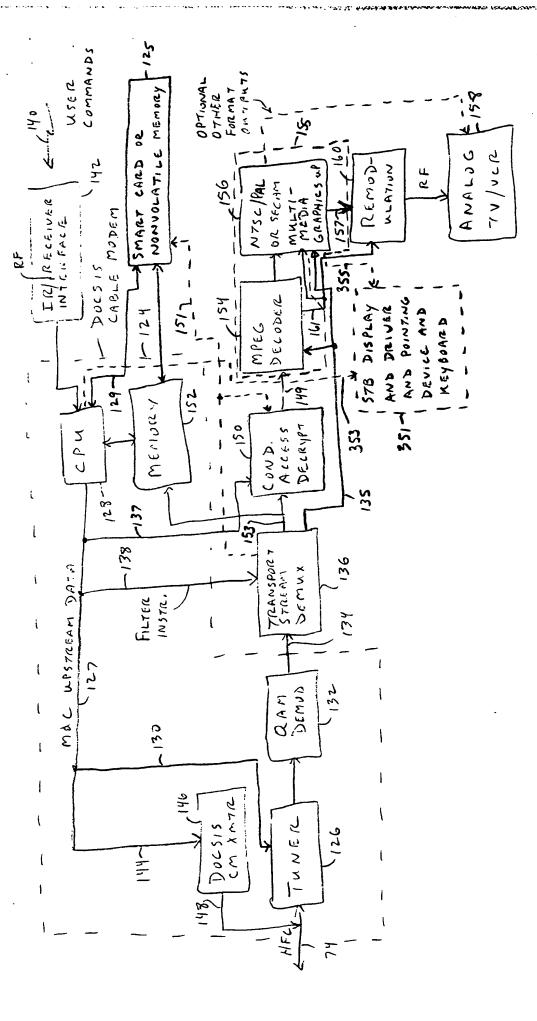
F16.6





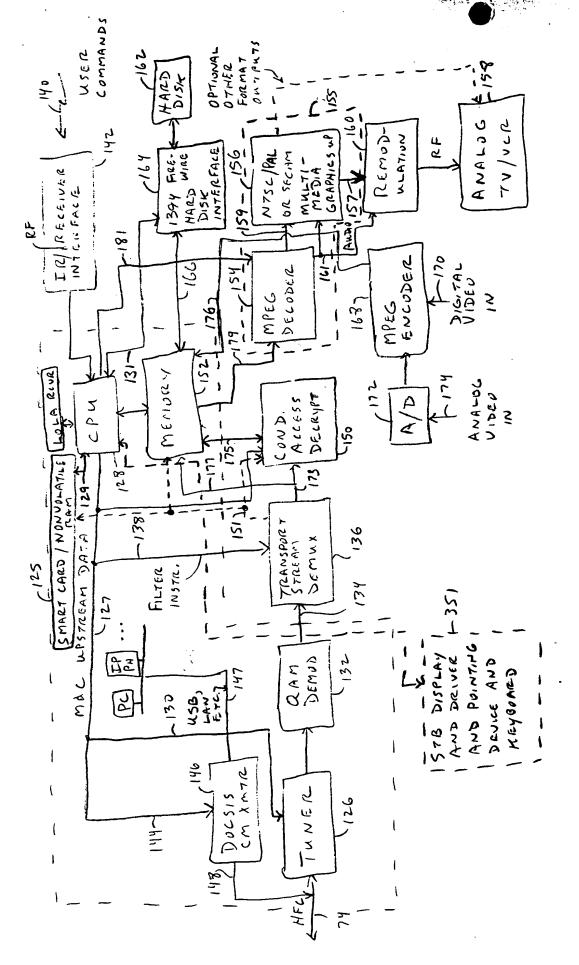
SIMPLE STB FOR DOCSIS M&C CHANNEL

F15. 2



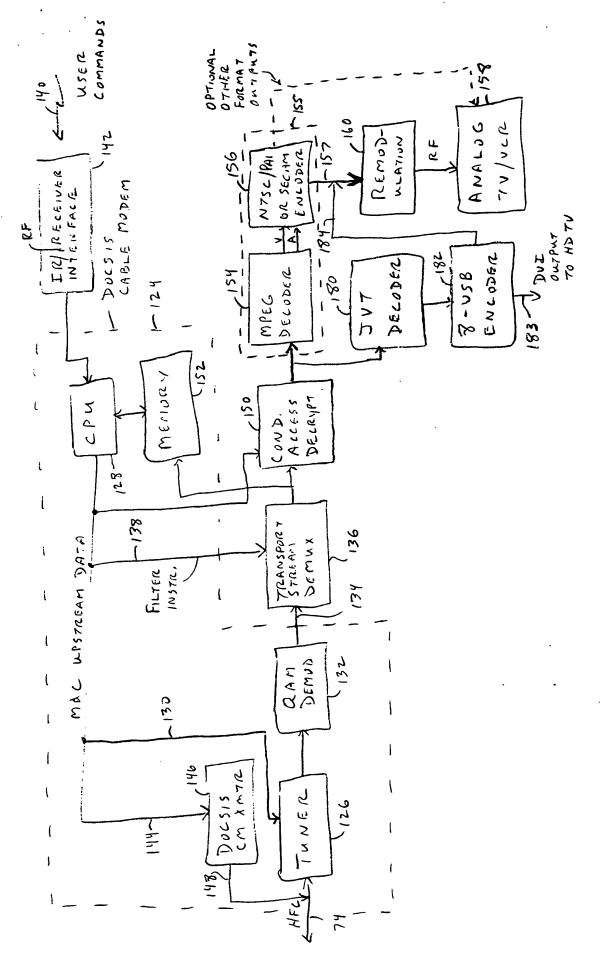
SIMPLE STB FOIL DUCSIS M&C CHANGLE

F16. 9



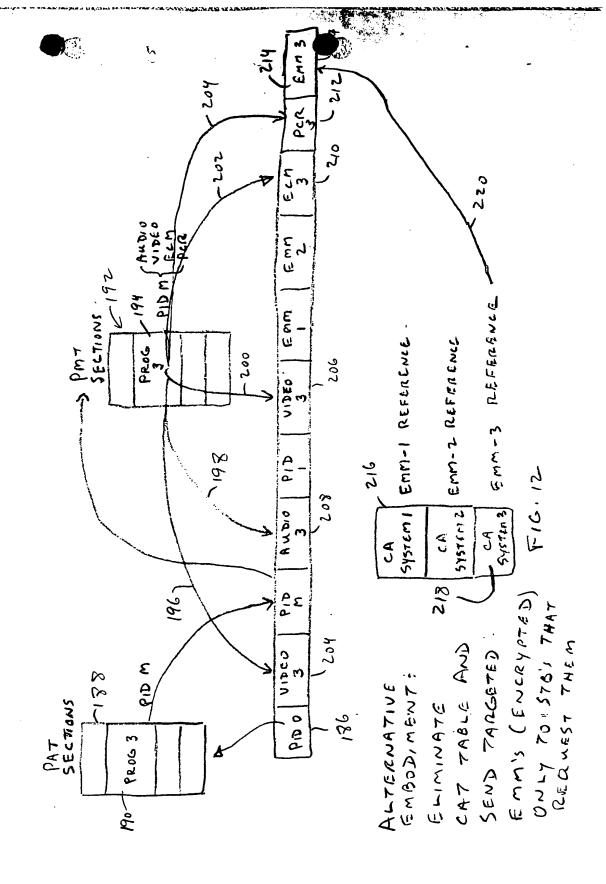
SINGLE TUNER WITH TIND FUNCTIONALITY SIMPLE STB FOR DOCSIS M&C CHANNEL

F16. \$ 10



SIMPLE STB FOR DOCSIS MAC CHANNEL

F16.11



## PROCESS FOR PROVIDING MANAGEMENT AND CONTROL DATA IN-BAND ON AN MPEG MULTIPLEX ON THE DOCSIS PID

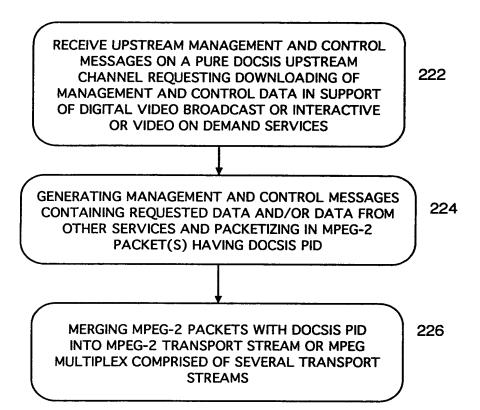
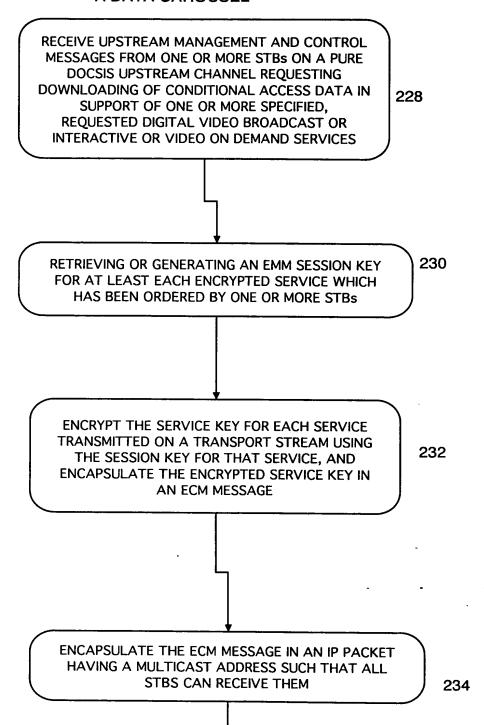


FIG. 13

# PROCESS FOR PROVIDING TARGETED CONDITIONAL ACCESS DATA IN-BAND ON AN MPEG MULTIPLEX WITHOUT USING A DATA CAROUSEL



**FIG. 14A** 

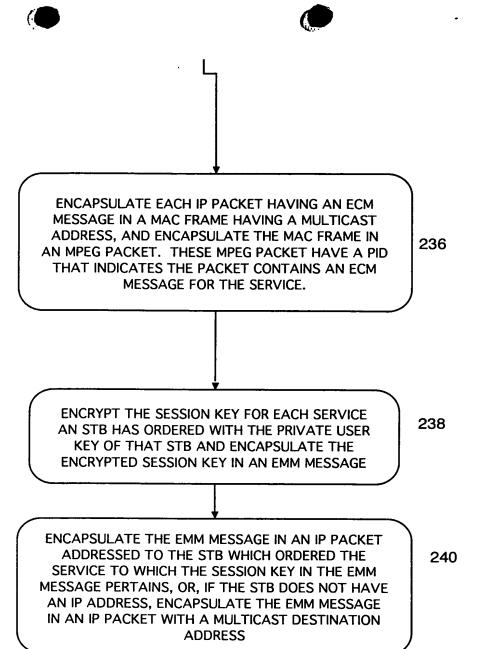


FIG. 14B

ENCAPSULATE EACH IP PACKET CONTAINING AN EMM MESSAGE FOR A PARTICULAR REQUESTED SERVICE INTO A MAC FRAME ADDRESSED TO THE STB WHICH REQUESTED THE SERVICE, AND ENCAPSULATE THE MAC FRAME IN AN MPEG PACKET HAVING THE DOCSIS PID ALONG WITH OTHER MPEG PACKETS HAVING THE DOCSIS PID AND CONTAINING OTHER M&C DATA. IN ALTERNATIVE EMBODIMENTS, ENCAPSULATE THE IP PACKET IN AN MPEG PACKET HAVING A PID WHICH INDICATES IT IS AN EMM MESSAGE FOR A PARTICULAR SERVICE AND ENTER THAT PID IN THE CAT TABLE FOR THE TRANSPORT STREAM ON WHICH THE EMM MESSAGE IS TRANSMITTED

242

ADD THE MPEG PACKETS THAT BEAR THE EMM AND ECM MESSAGES FOR EACH SERVICE IN THE MPEG TRANSPORT STREAM WHICH CONTAINS THE MPEG PACKETS BEARING ENCRYPTED DATA OF SAID SERVICE AND MERGE OTHER MPEG PACKETS HAVING THE DOCSIS PID AND CONTAINING OTHER M&C DATA INTO THE ONE OR MORE TRANSPORT STREAMS OF THE MPEG MULTIPLEX

244

ADJUST DATA IN PAT AND PMT TABLES OF SAID MPEG TRANSPORT STREAM OR MULTIPLEX TO REFLECT THE PIDS OF SAID PACKETS CONTAINING THE ENCRYPTED AUDIO, VIDEO OR OTHER PAYLOAD DATA OF THE SERVICE, THE PCR TIMING DATA, AND THE ECM PACKET FOR THE SERVICE. ADJUST THE CONDITIONAL ACCESS TABLE TO INCLUDE DATA TO POINT TO THE EMM MESSAGE FOR EACH SESSION F THE DOCSIS PID IS NOT USED TO SEND THE EMM MESSAGES.

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SERVICE

FIG. 14C

A VITTE DAY THE PIECE

# PROCESS CARRIED OUT IN STB TO RECOVER EMM AND ECM MESSAGES FROM AN IN-BAND CHANNEL AND DECRYPT PAYLOAD DATA OF REQUESTED SERVICE

MICROPROCESSOR RECEIVES COMMANDS TO ORDER AN INTERACTIVE OR OTHER SERVICE OR TUNE A DIGITAL VIDEO BROADCAST, AND GENERATES AND SENDS UPSTREAM DOCSIS M&C MESSAGE REQUESTING APPROPRIATE APPLICATION SOFTWARE, PROGRAM GUIDE DATA, CONDITIONAL ACCESS DATA, ETC. (IF ANY) FOR REQUESTED SERVICE

248

MICROPROCESSOR GENERATES FILTER COMMANDS TO CAUSE PID 0 PACKETS TO BE EXTRACTED FROM DOWNSTREAM MPEG TRANSPORT STREAM MULTIPLEX AND SENT TO IT FOR RE-CONSTRUCTION OF THE PROGRAM ALLOCATION (PAT) TABLE OF THE MPEG MULTIPLEX, AND RE-CONSTRUCTS THE PAT TABLE FROM THE EXTRACTED PACKETS

250

MICROPROCESSOR USES PAT TABLE TO DETERMINE WHICH TRANSPORT STREAMS ARE IN THE MPEG MULTIPLEX AND WHICH TRANSPORT STREAM CONTAINS THE MPEG PACKETS OF THE DESIRED SERVICE, AND DETERMINES THE PID OF THE MPEG PACKETS THAT CONTAIN THE PROGRAM MAP TABLE (PMT) OF THE TRANSPORT STREAM CONTAINING THE REQUESTED SERVICE

252

MICROPROCESSOR GENERATES FILTER COMMANDS TO EXTRACT.
MPEG PACKETS CONTAINING THE PMT TABLE DATA AND RECONSTRUCTS PMT TABLE FROM THOSE PACKETS

254

MICROPROCESSOR SEARCHES PMT TABLE FOR ENTRY FOR REQUESTED SERVICE AND DETERMINES PID NUMBERS FOR THE VIDEO, AUDIO, SUPPLEMENTARY DATA, PCR AND ECM MESSAGES OF THE REQUESTED SERVICE AND GENERATES FILTER COMMANDS TO EXTRACT PACKETS WITH THOSE PIDS.

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FIG. 15A



PROGRAM DATA RECOVERY AND ROUTING:

MAC FRAMES-IN EXTRACTED MPEG PACKETS CONTAINING
ENCRYPTED VIDEO, AUDIO, SUPPLEMENTAL DATA, PCR DATA AND
ECM MESSAGE DATA ARE RECOVERED AND ANY MAC PRAMES NOT
ADDRESSED TO THIS STB-ARE REJECTED. IP PACKETS CONTAINING
SERVICE DATA AND ECM MESSAGE DATA ENCAPSULATED IN MAC
FRAMES-ARE RECOVERED AND ROUTED TO APPROPRIATE CIRCUITS
IN STB OR CONNECTED TO STB BY BUS OR LAN FOR FURTHER
PROCESSING

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#### **EMM MESSAGE RECOVERY:**

IN EMBODIMENTS WHERE THE EMM MESSAGE IS SENT ON THE DOCSIS PID, THE MICROPROCESSOR GENERATES FILTER COMMANDS TO EXTRACT MPEG PACKETS HAVING DOCSIS PID AND RECOVERS MAC FRAMES OF DOCSIS PID PACKETS CARRYING THE EMM MESSAGE AND REJECTS ALL MAC FRAMES NOT ADDRESSED TO THIS STB.

260

IN EMBODIMENTS WHERE A CAT TABLE IS USED, PID 1 PACKETS ARE EXTRACTED AND THE MAC FRAMES THEREIN ARE RECOVERED, AND THESE MAC FRAMES ARE ROUTED TO A CAT TABLE RE-CONSTRUCTION PROCESS. THE MICROPROCESSOR RECONSTRUCTS THE CAT TABLE, FINDS EMM PID, GENERATES FILTER COMMANDS FOR THIS PID AND EXTRACTS THE MPEG PACKETS CONTAINING THE EMM MESSAGE FOR THE REQUESTED SERVICE FROM MULTIPLEX. THE MAC FRAMES IN THE EXTRACTED PACKETS CONTAINING THE EMM MESSAGE FOR THE REQUESTED SERVICE ARE RECOVERED

RECOVER IP PACKETS CONTAINING EMM AND ROUTE:
MICROPROCESSOR RECOVERS IP PACKETS FROM MAC FRAMES
RECOVERED IN STEP 260 BEARING EMM MESSAGE(S) AND ROUTES
IT/THEM TO THE EMM MESSAGE DECRYPTION PROCESS.

262 -

MPEG PACKETS WITH THE DOCSIS PID CARRYING OTHER M&C DATA ARE RECOVERED, THE MAC FRAMES AND ENCAPSULATED IP FRAMES ARE RECOVERED AND THE M&C DATA IS ROUTED TO THE APPROPRIATE CIRCUITRY IN THE STB OR CONNECTED TO THE STB BY BUS OR LAN CONNECTION FOR FURTHER PROCESSING

FIG. 15B

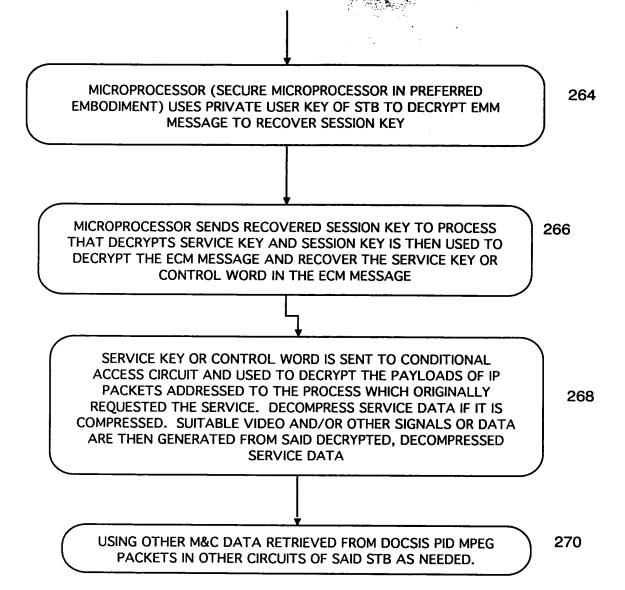


FIG. 15C

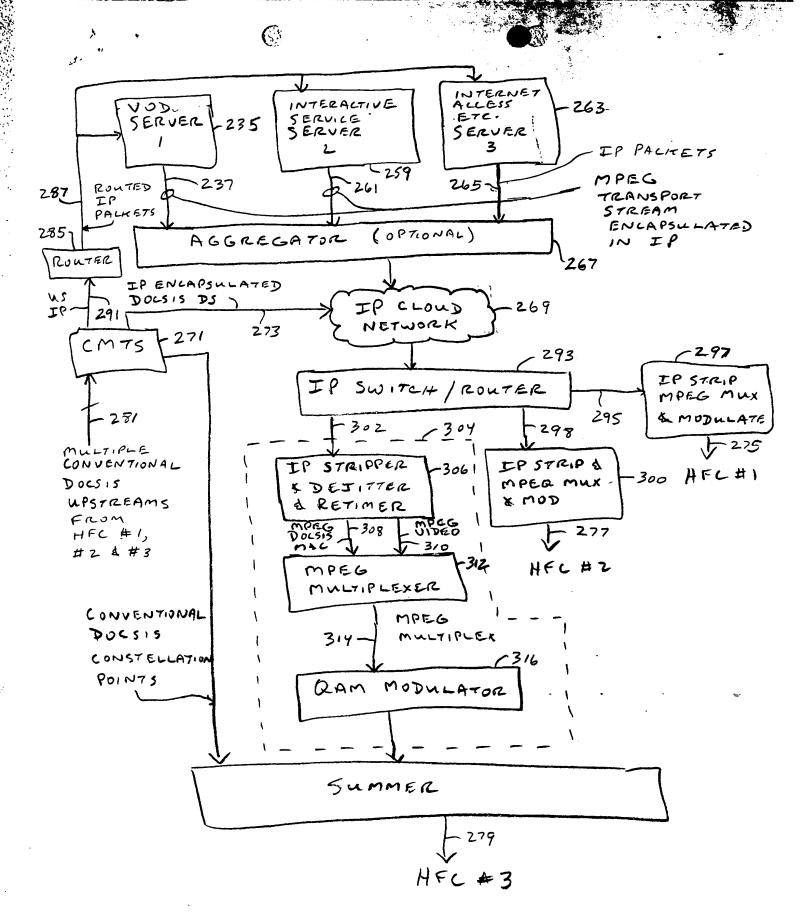


FIG. 16

# PROCESS CARRIED OUT BY SIMPLE, SINGLE TUNER STB TO RECEIVE ENCRYPTED DIGITAL VIDEO BROADCASTS

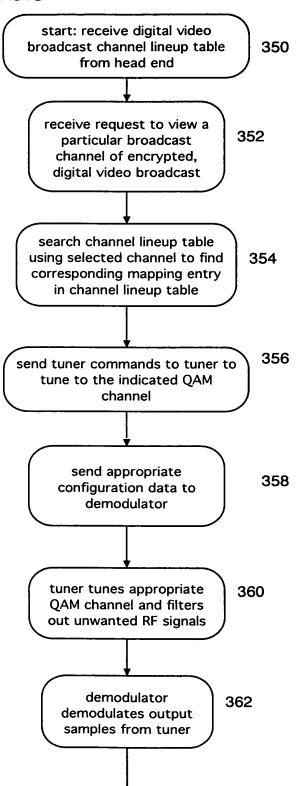
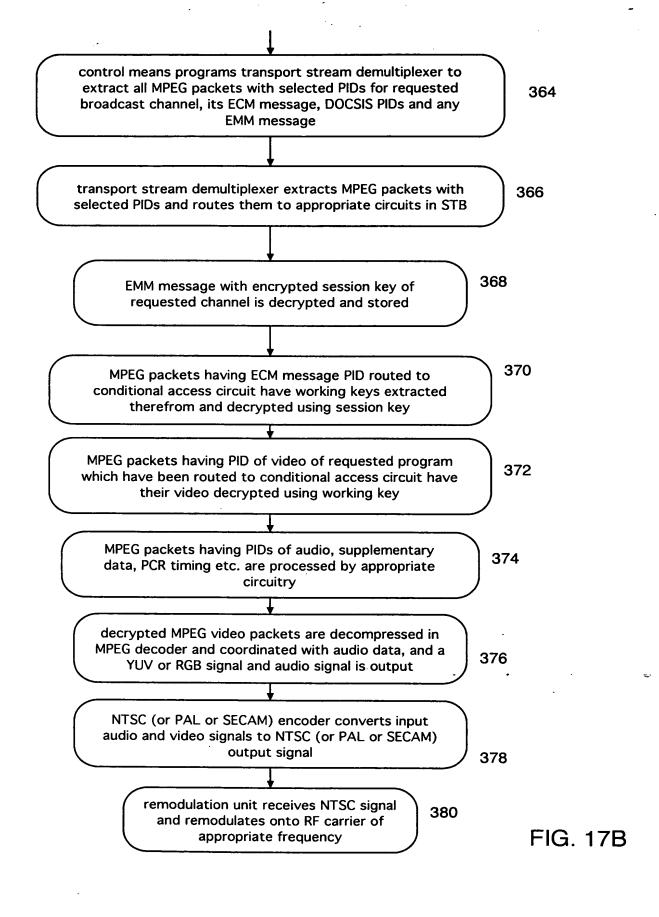
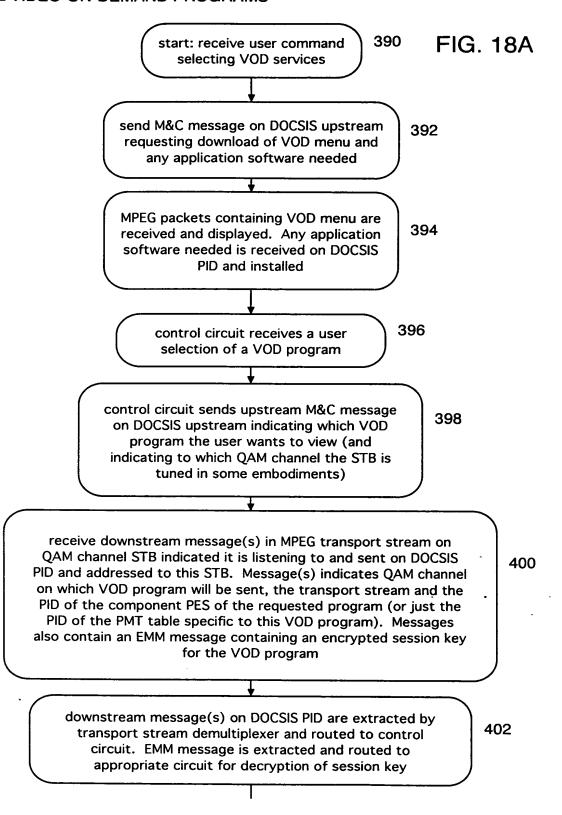


FIG. 17A



## PROCESS CARRIED OUT BY SIMPLE, SINGLE TUNER STB TO RECEIVE ENCRYPTED DIGITAL VIDEO-ON-DEMAND PROGRAMS



control circuit processes message to determine which QAM channel VOD program will be sent on, 404 which MPEG transport stream will carry the program, and the PIDs of the component PES of the program or the PMT table FIG. 18B control circuit sends appropriate tuning 406 commands to tuner and appropriate configuration data to the demodulator for the QAM channel program will be sent upon session key is decrypted in appropriate 408 circuit using private user data key of this STB with which the session key was encrypted and sent to conditional access circuit control circuit uses PIDs in downstream 410 message to program transport stream demultiplexer transport stream demultiplexer uses PIDs in 412 downstream message to extract MPEG packets of VOD program and route them to appropriate circuitry MPEG packets with encrypted ECM 414 message are extracted and sent to appropriate circuit for decryption and recovery of working key MPEG packets with encrypted video are 416 sent to conditiona access circuit and decrypted using working key and sent to MPEG decoder

